# Towards Semantic Libraries

# The Container, the Content and the Contenders

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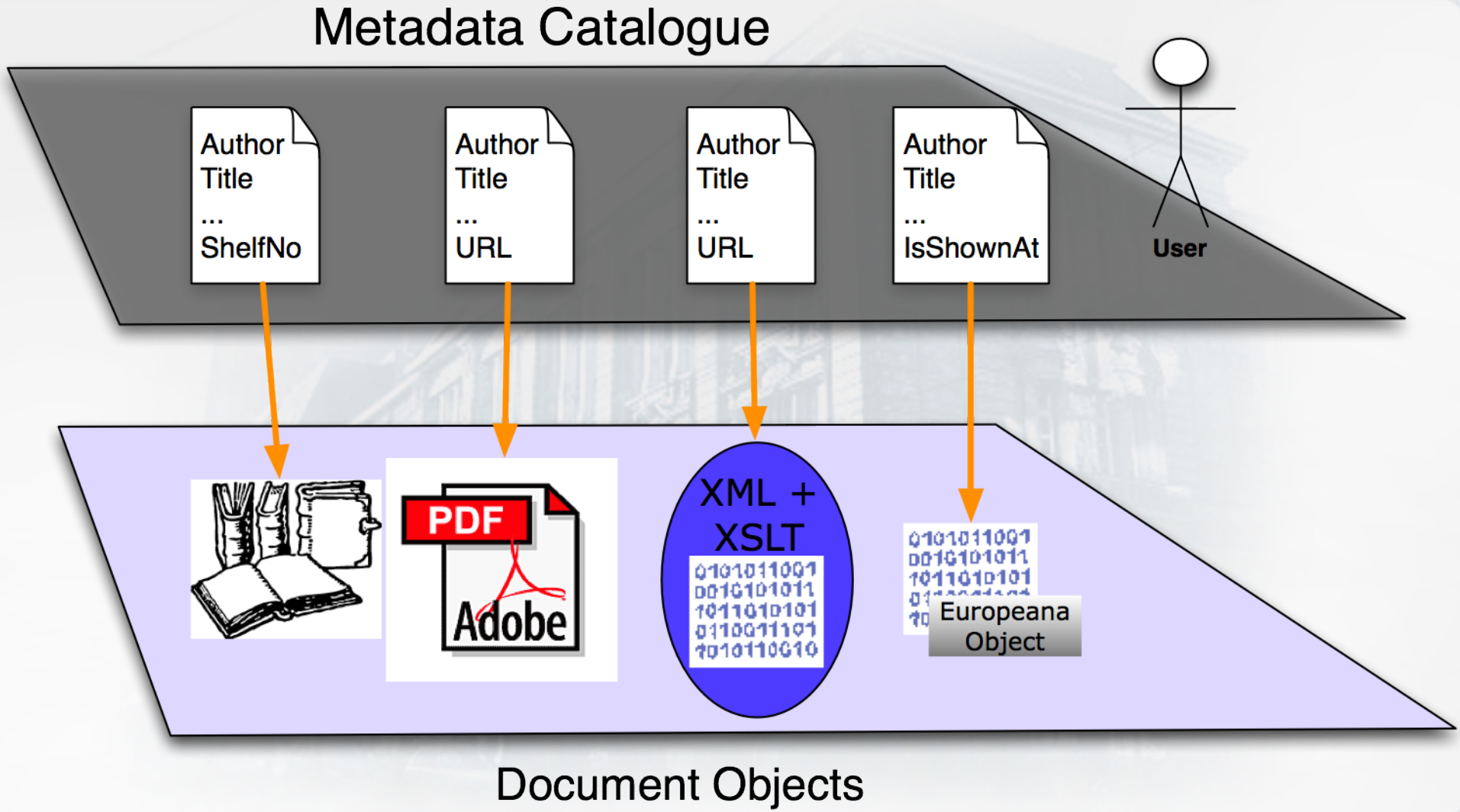
# … à la carte:
# A Three-Course Menu

- Hors d'oeuvre: Where are we coming from?
  Basics of Library Functionality
- Main course: Where are we going to?
  Semantic (Digital) Libraries
- Dessert: Who else is going there?
  Partners and Contenders

# Hors d'Oeuvre
# Where are we coming from?
# Basics of Library Functionality

# Library Functional Principles (1)

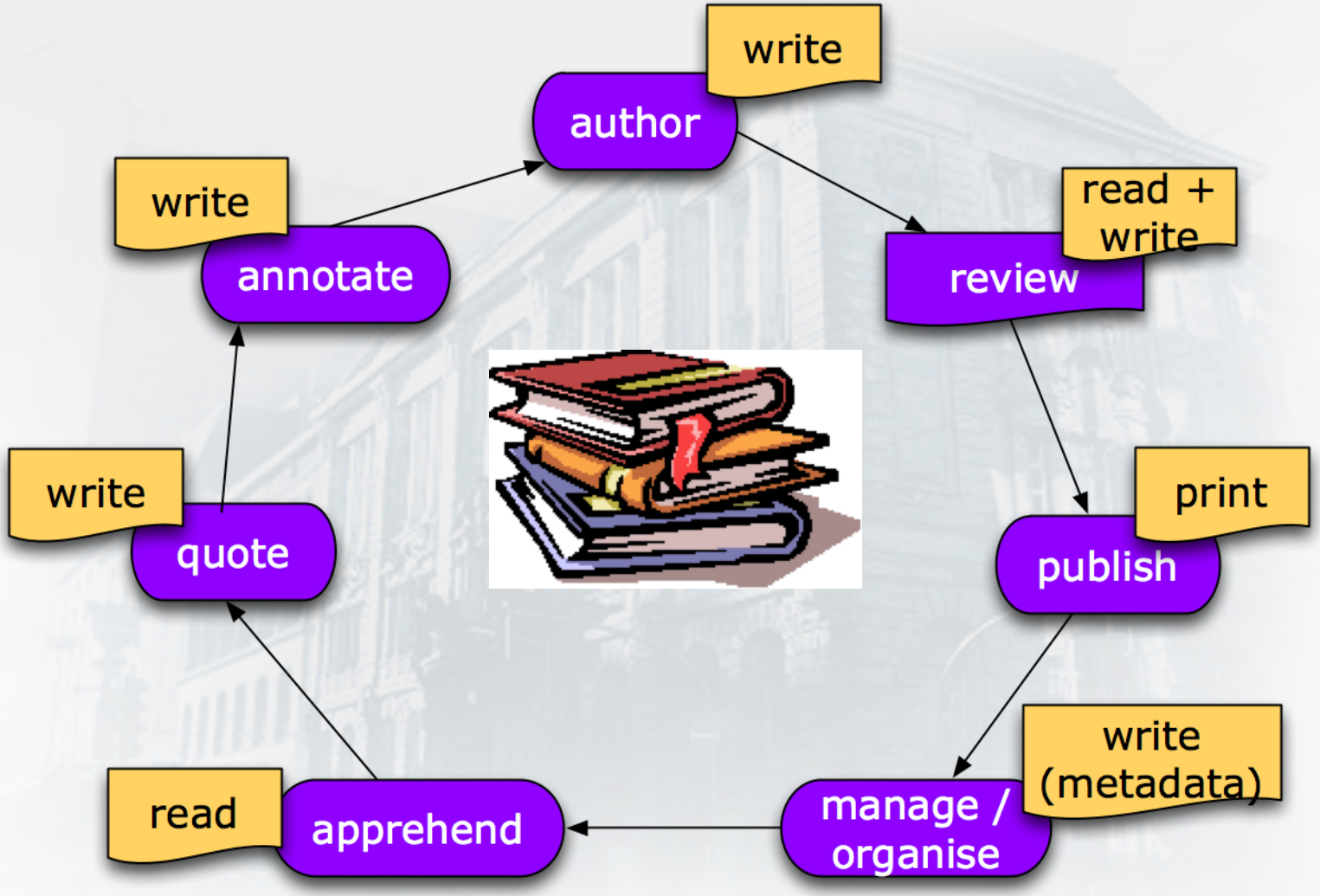


# Library Functional Principles (2)

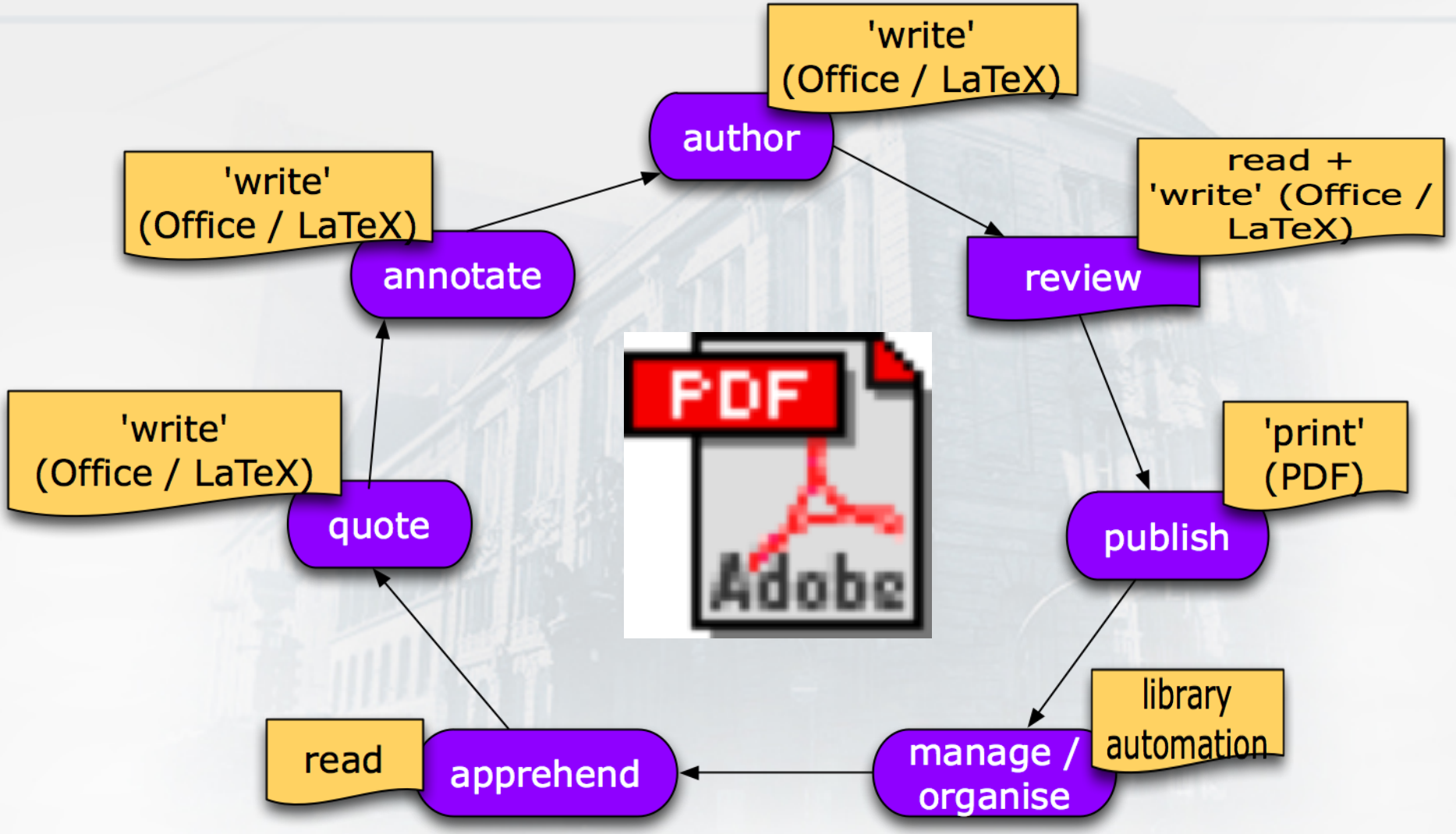
- **Mediating access** to information objects via **catalogues**
- **Mediating links** as pointers from metadata to objects
- Objects are part of a library **collection**
  - An object to be used within a library typically is part of this library's collection
- Internal processing logic: focus on
  - objects as information **containers**,
  - not so much on the **content** of these containers
- **Ingestion**, **storage**, **description** and **retrieval** of information objects as functional macro-primitives

# Main Course
# Where are we going to?
# Towards the Semantic Library

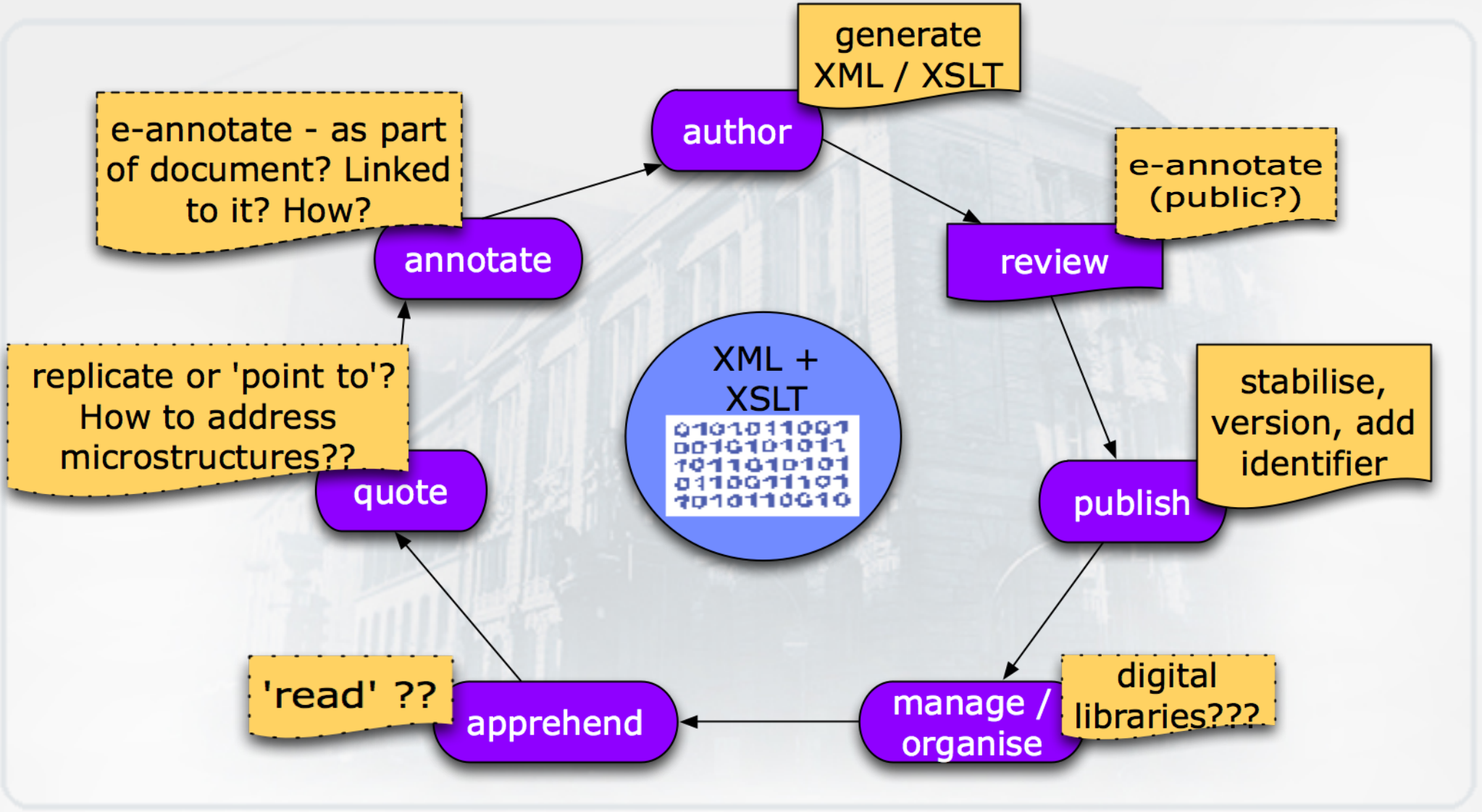
# Linear Document Continuum ...
# ... in the Gutenberg galaxy



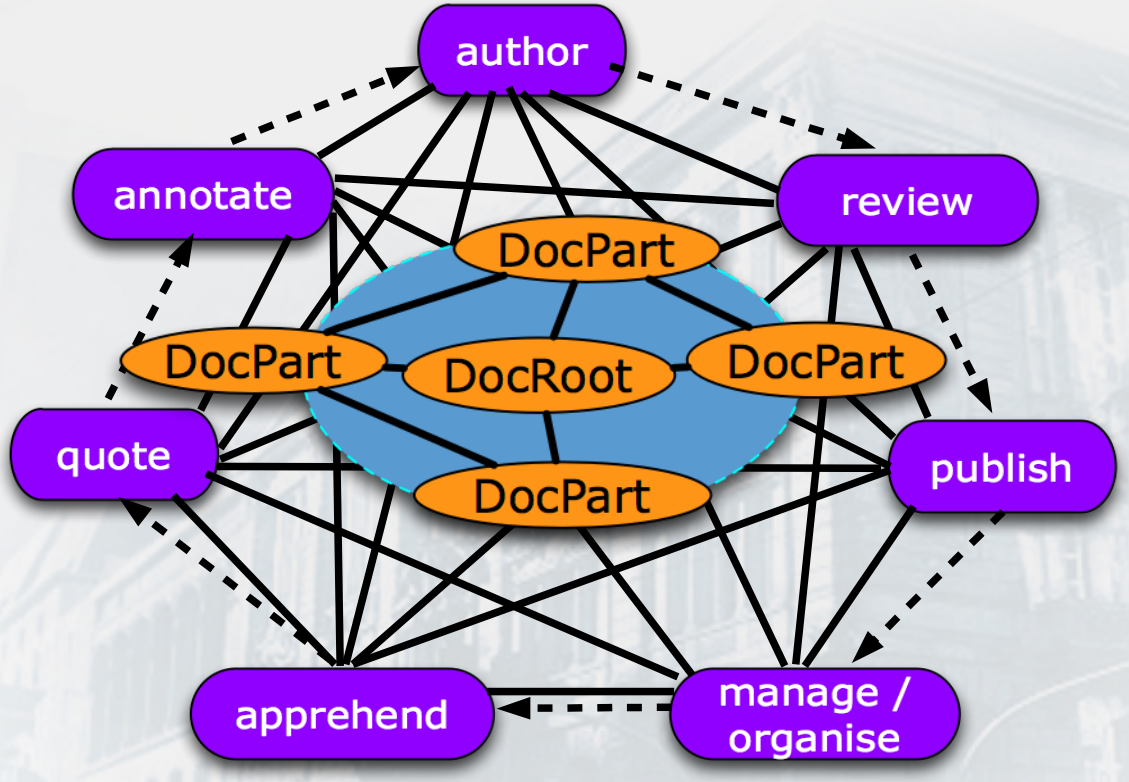
# Linear Document Continuum ...
# … in emulation mode



# Linear Document Continuum ...
# … going digital (entering Turing galaxy)

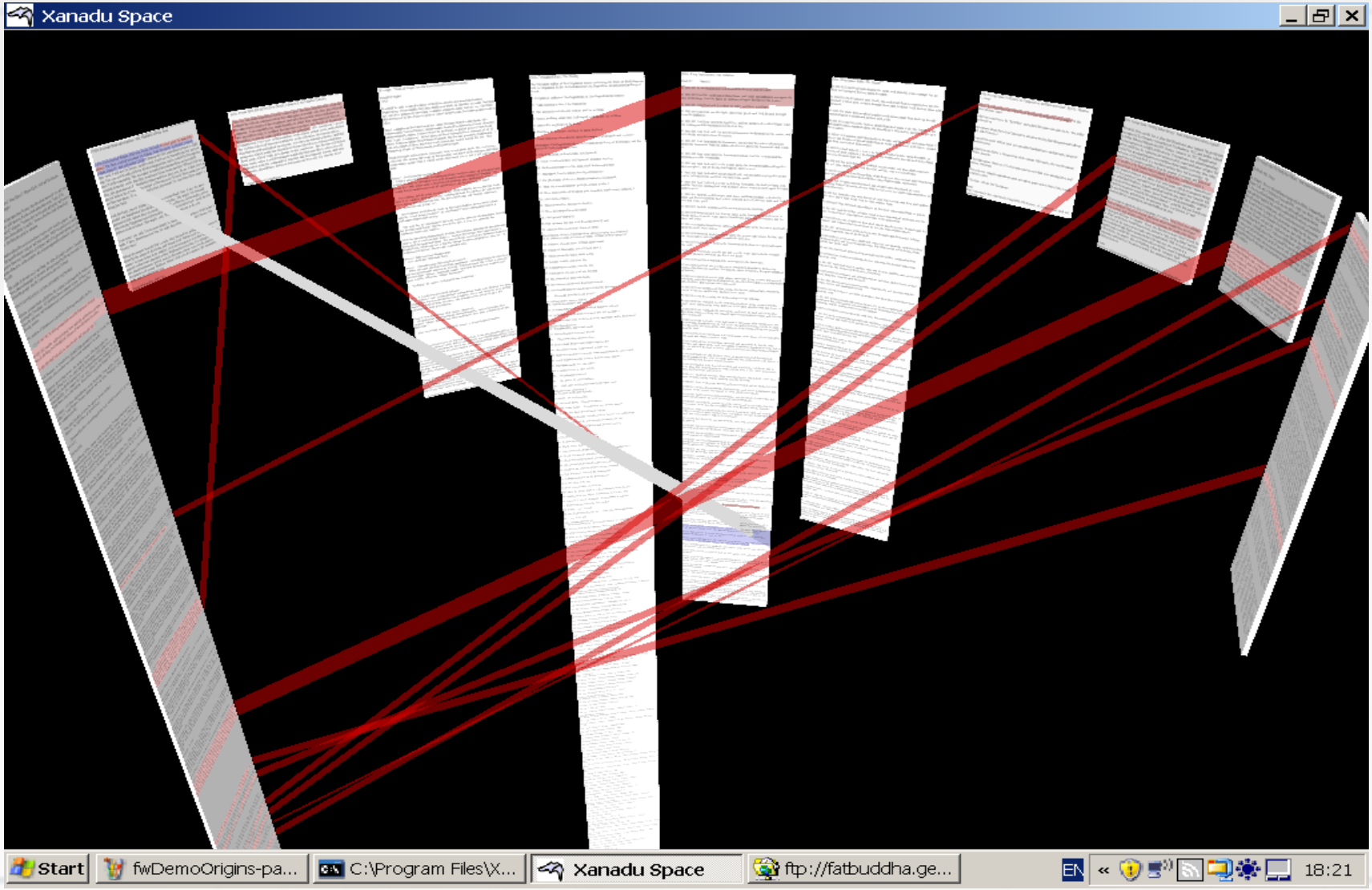


# Web Based Scholarly Working Continuum ...
# … a triple paradigm shift: Beyond Documents

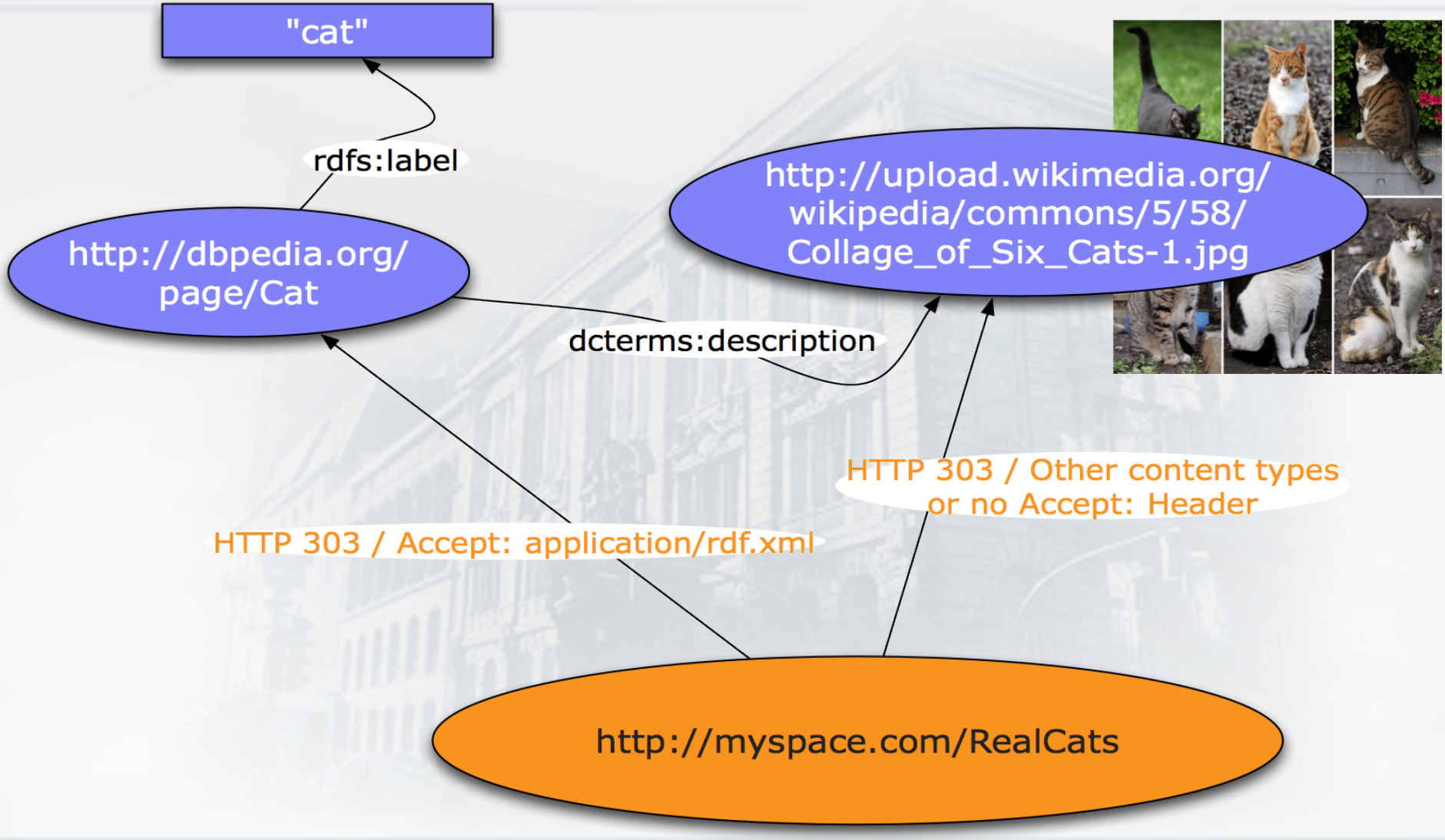



- Decreasing functional determination by traditional cultural techniques
- Disintegration of the linear / circular functional paradigma
- Erosion of the monolithic document notion in hypertext paradigms

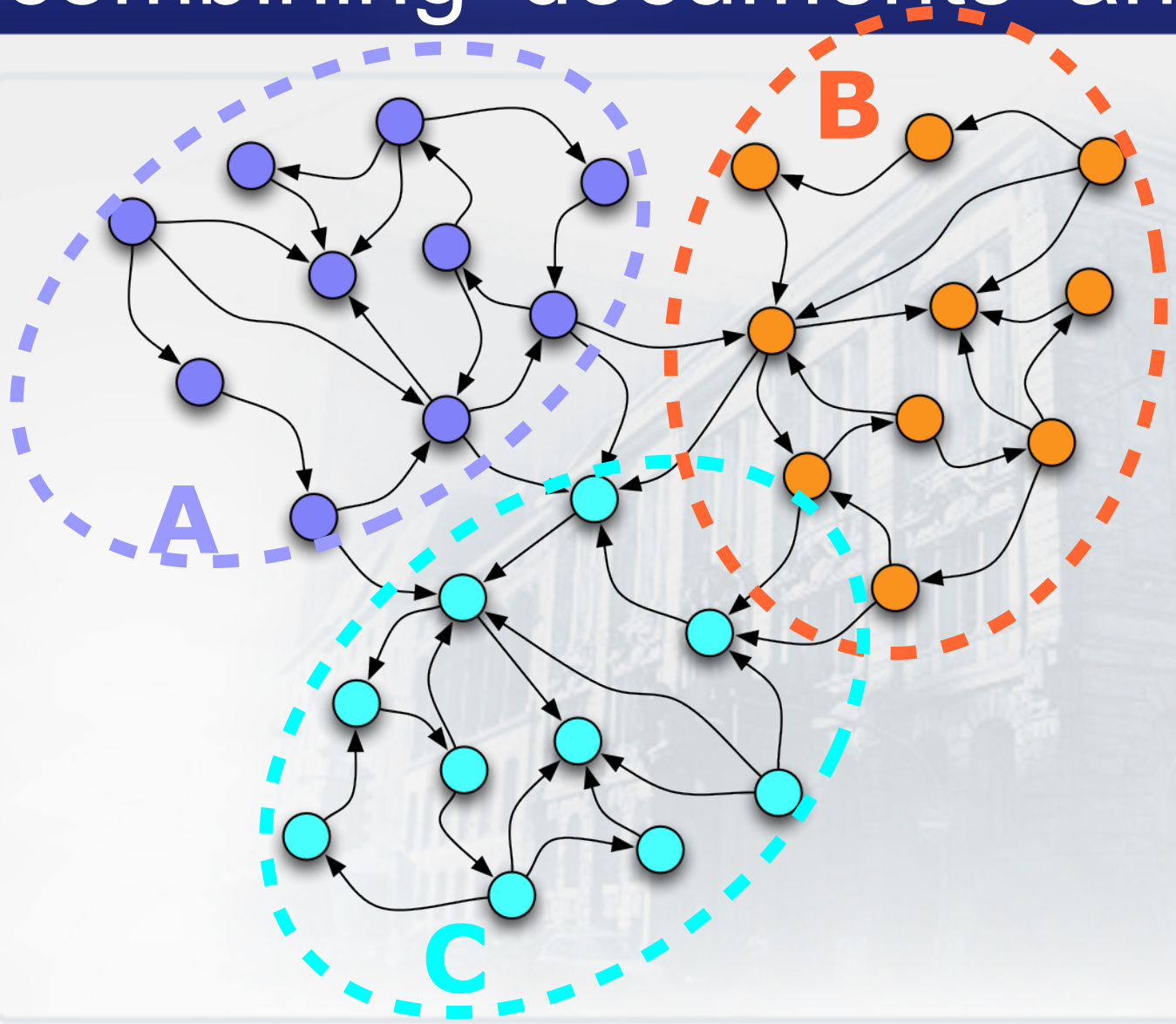
# Ted Nelson's Xanadu: radicalised Hypertext ...



# … the web of 'documents' extended with a web of 'things' …

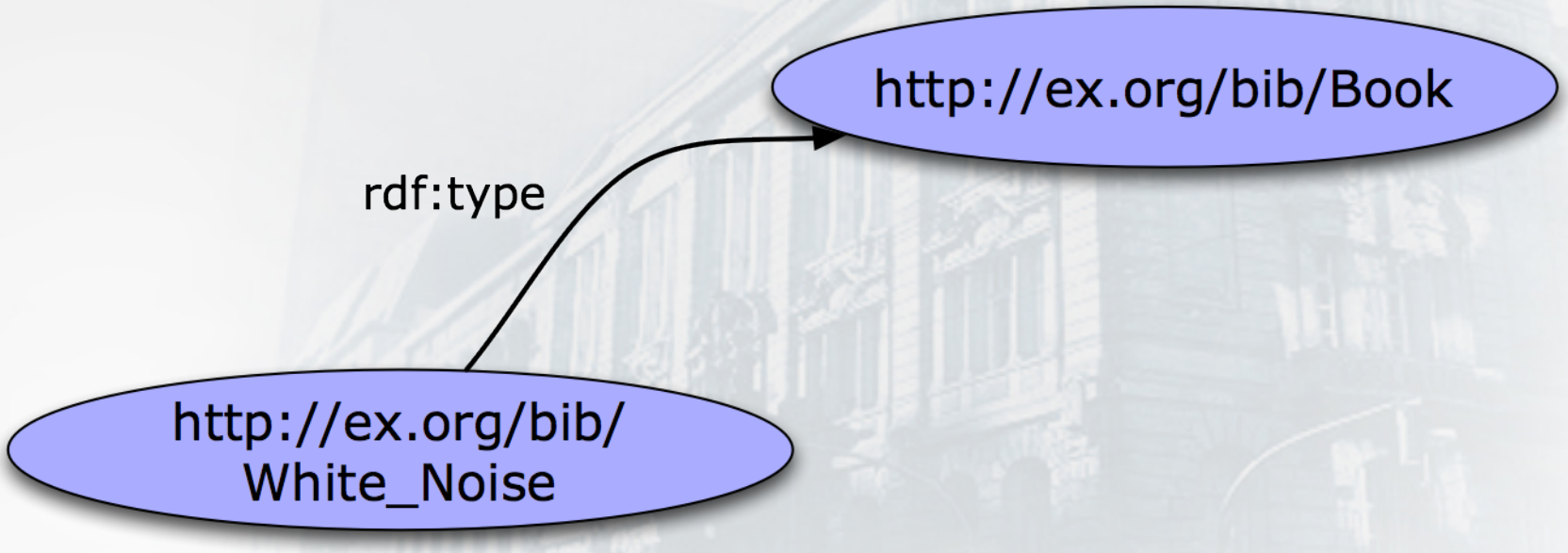


# … and 'publication' aggregations combining 'documents' and 'things'



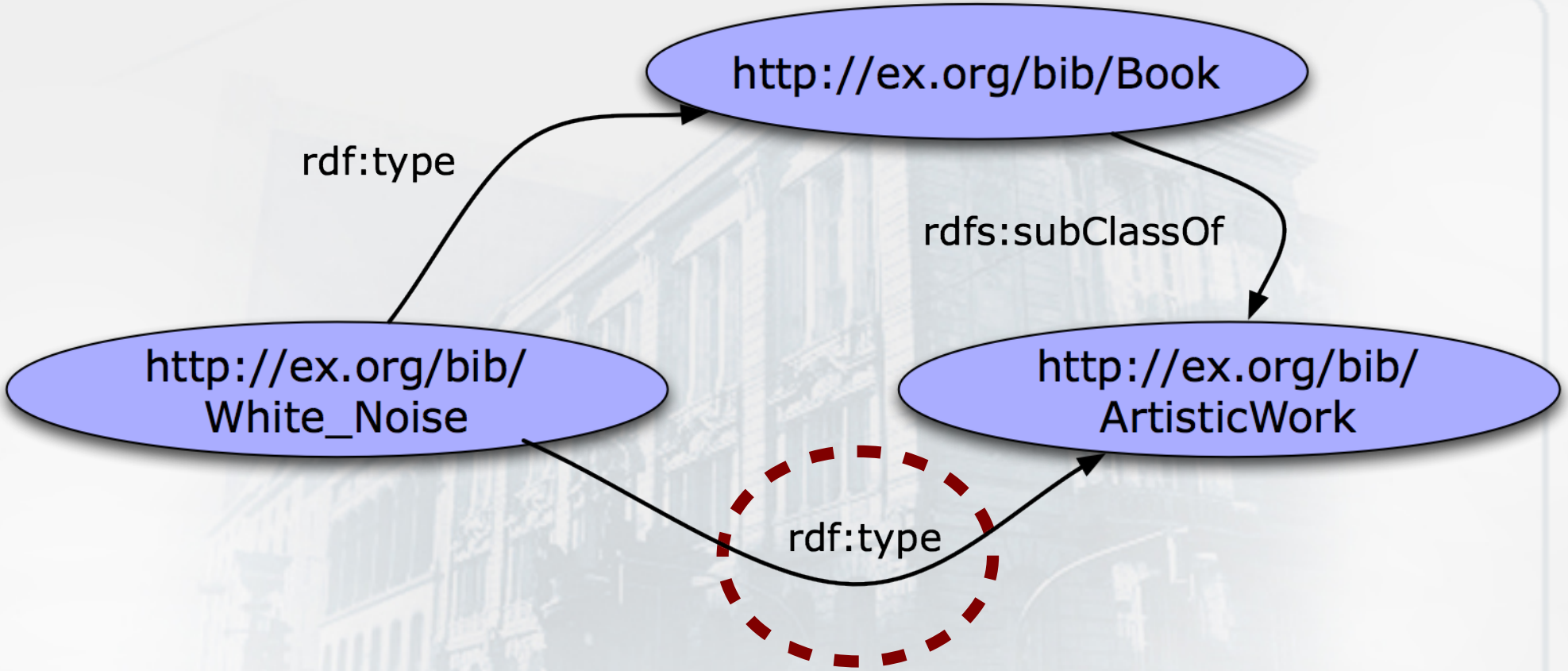

- Where do resource aggregations 'start'? Where do they 'end'?
- And what constitutes document boundaries??
- And which node was connected to which one at a given time???

# Machines can reason on triple sets!



# Some reasoning preconditions ...

# … and an automated inference!




There is quite some potential for generating scholarly heuristics here!

# The use of Inferences

Citation: van Haagen HHHBM, 't Hoen PAC, Botelho Bovo A, de Morrée A, van Mulligen EM, et al. (2009) Novel Protein-Protein Interactions Inferred from Literature Context. PLoS ONE 4(11): e7894. doi:10.1371/journal.pone.0007894 / Example provided by Jan Velterop

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**Novel Protein-Protein Interactions Inferred from Literature Context**

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**Herman H. H. B. M. van Haagen[1*], Peter A. C. 't Hoen[1], Alessandro Botelho Bovo[2], Antoine de Morrée[1], Erik M. van Mulligen[1], Christine Chichester[1], Jan A. Kors[1], Johan T. den Dunnen[1], Gert-Jan B. van Ommen[1], Silvère M. van der Maarel[1], Vinícius Medina Kern[2], Barend Mons[1], Martijn J. Schuemie[1]**

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## Abstract Top

We have developed a method that predicts Protein-Protein Interactions (PPIs) based on the similarity of the context in which proteins appear in literature. This method outperforms previously developed PPI prediction algorithms that rely on the conjunction of two protein names in MEDLINE abstracts. We show

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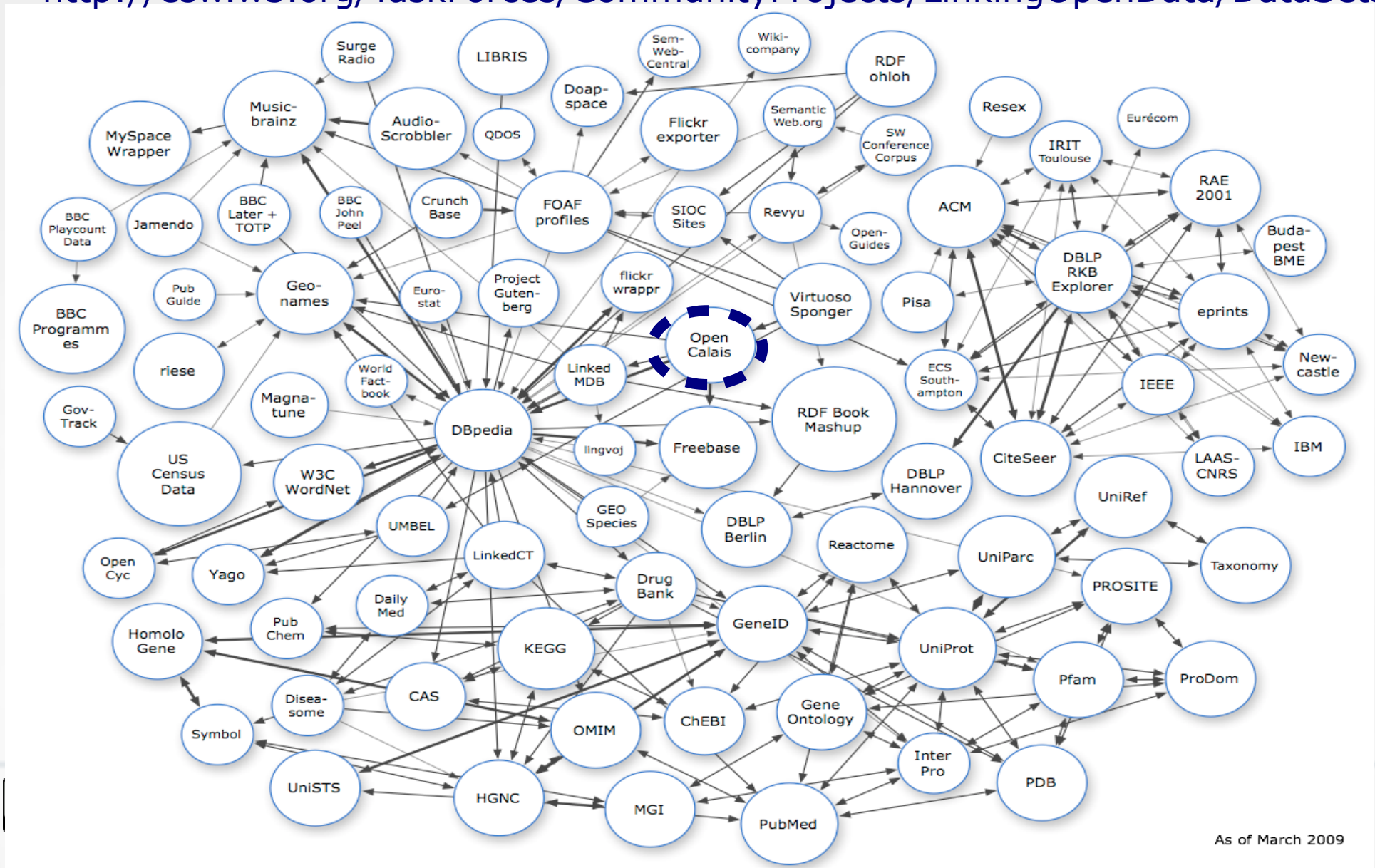
# LoD: Billions of Triples …
# … and Semantic Publishing!

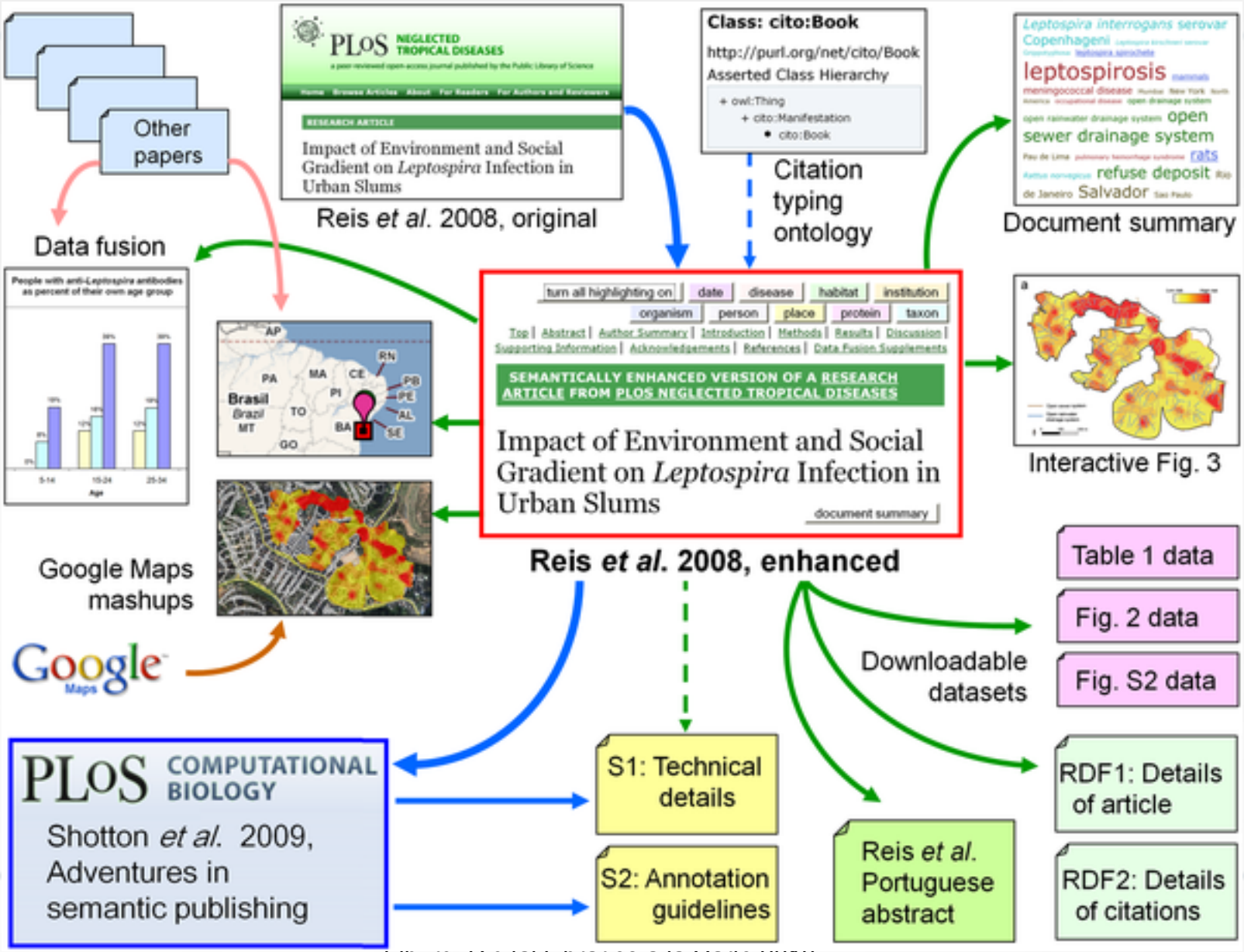
http://esw.w3.org/TaskForces/CommunityProjects/LinkingOpenData/DataSets



# Semantic Publishing as Defined by Shotton

- Shotton et al. (2009b) define semantic publication to include anything that
  - **enhances the meaning** of a published journal article,
  - **facilitates** its automated **discovery**,
  - enables its **linking to semantically related articles**,
  - provides **access to data within the article** in actionable form, or
  - facilitates **integration of data between articles**.
- Example of an enhanced article

# Behind the Sceen



# Semantic Enrichment Tools

- Generic:
  - OpenCalais (http://www.opencalais.com/)
  - Temis (http://www.temis.com/)
- Specialised:
  - Bio Taxon Finder (http://www.ubio.org/index.php?pagename=xml_services)
  - ConceptWebAlliance (http://conceptwiki.org) (Biomedical, Jan Velterop)
- Good critique by Roderic Page: http://iphylo.blogspot.com/2009/04/semantic-publishing-towards-real.html
  - “linking terms to HTML pages doesn't get us much further. Great for humans, not so good for computers.”
  - Too much focus on journal article format!
- → We need a little more!

# Books: the Liquid Version

"Turning inked letters into electronic dots that can be read on a screen is simply the first essential step in creating this new library. The **real magic** will come in the second act, as each word in each book is

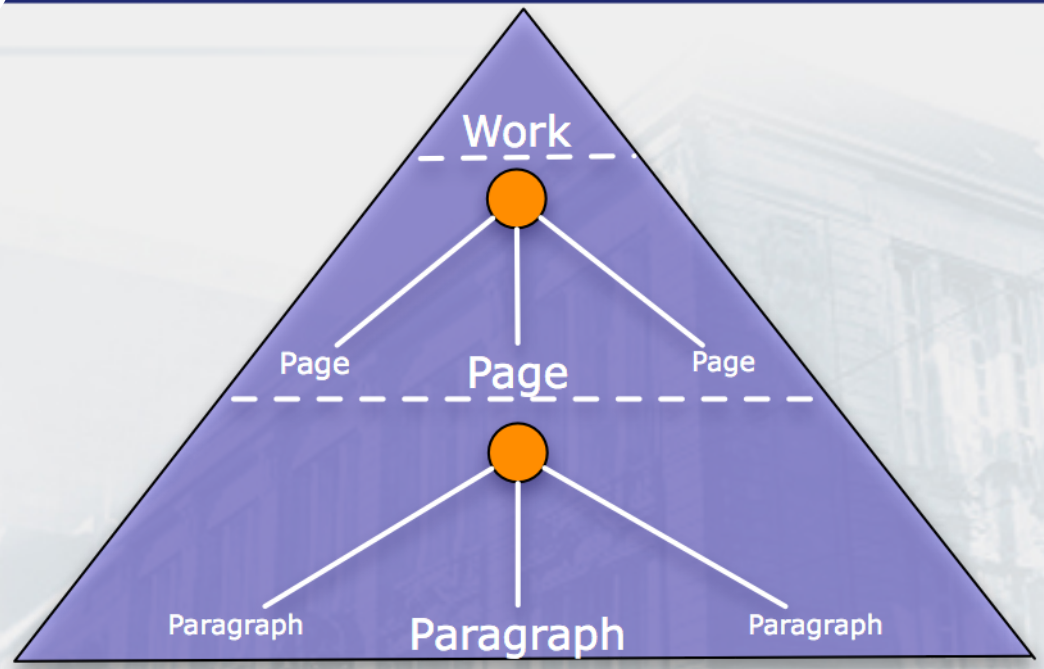
- cross-linked,
- clustered,
- cited, extracted,
- indexed,
- analyzed,
- annotated,
- remixed,
- reassembled

and woven deeper into the culture than ever before. In the new world of books, every bit informs another; every page reads all the other pages."
Kevin Kelly, The New York Times Magazine, May 14, 2006

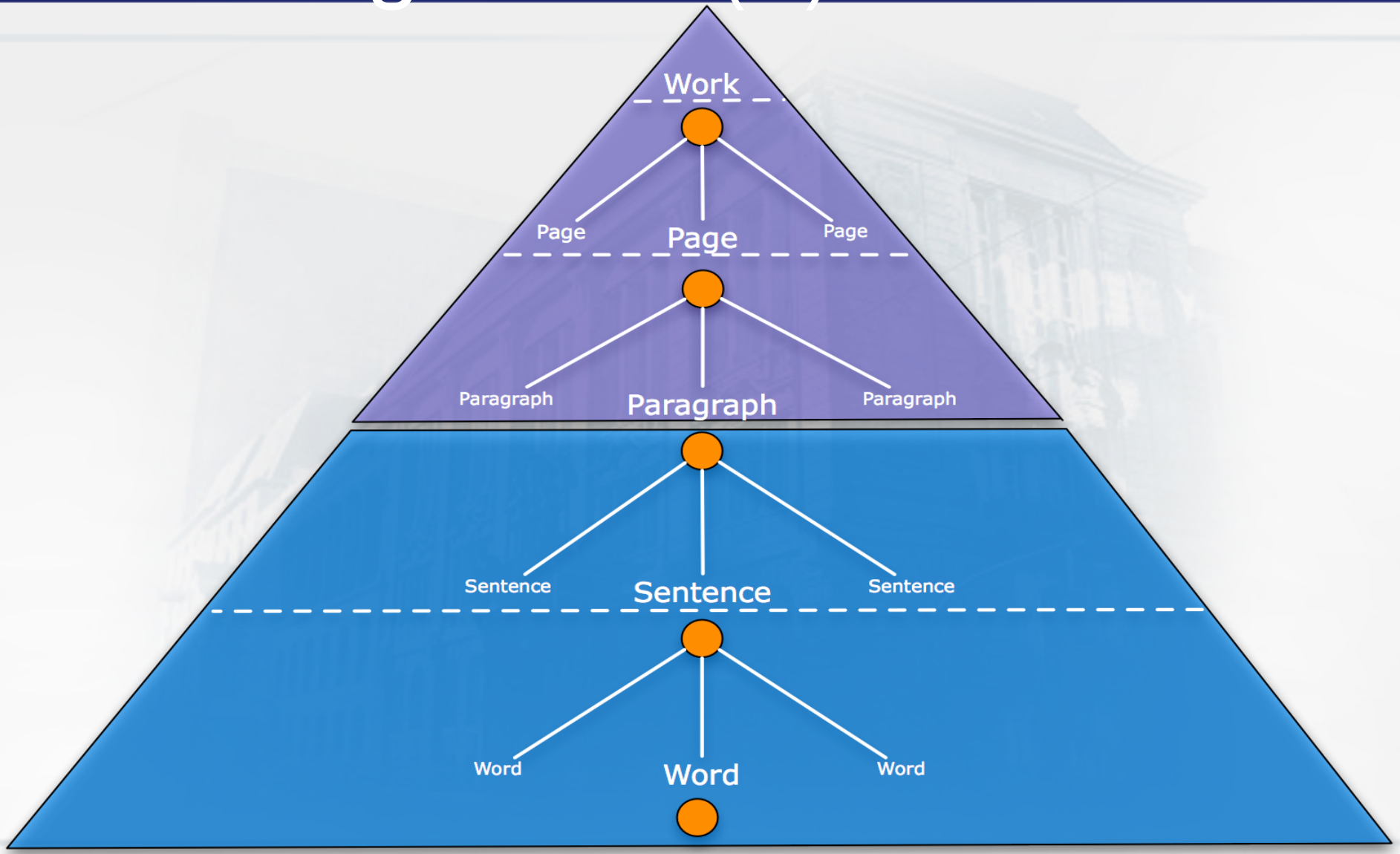
# Semantic Micro-Content: PAUX

- A **Semantic Wiki**,
- not based on static HTML pages, but instead consisting of **dynamic documents**,
- provided at runtime from **semantic microcontent** (“PAUX-Objects”),
- **semantically linked** by “PAUX-Links”
- Microcontent elements have **HTTP URIs**!
- → PAUX documents can be published as Linked (Open) Data aggregations with maximum granularity: down to **word level**.
- ***PAUX creates “liquid books”***
- PAUX (http://www.paux.de): origins in eLearning

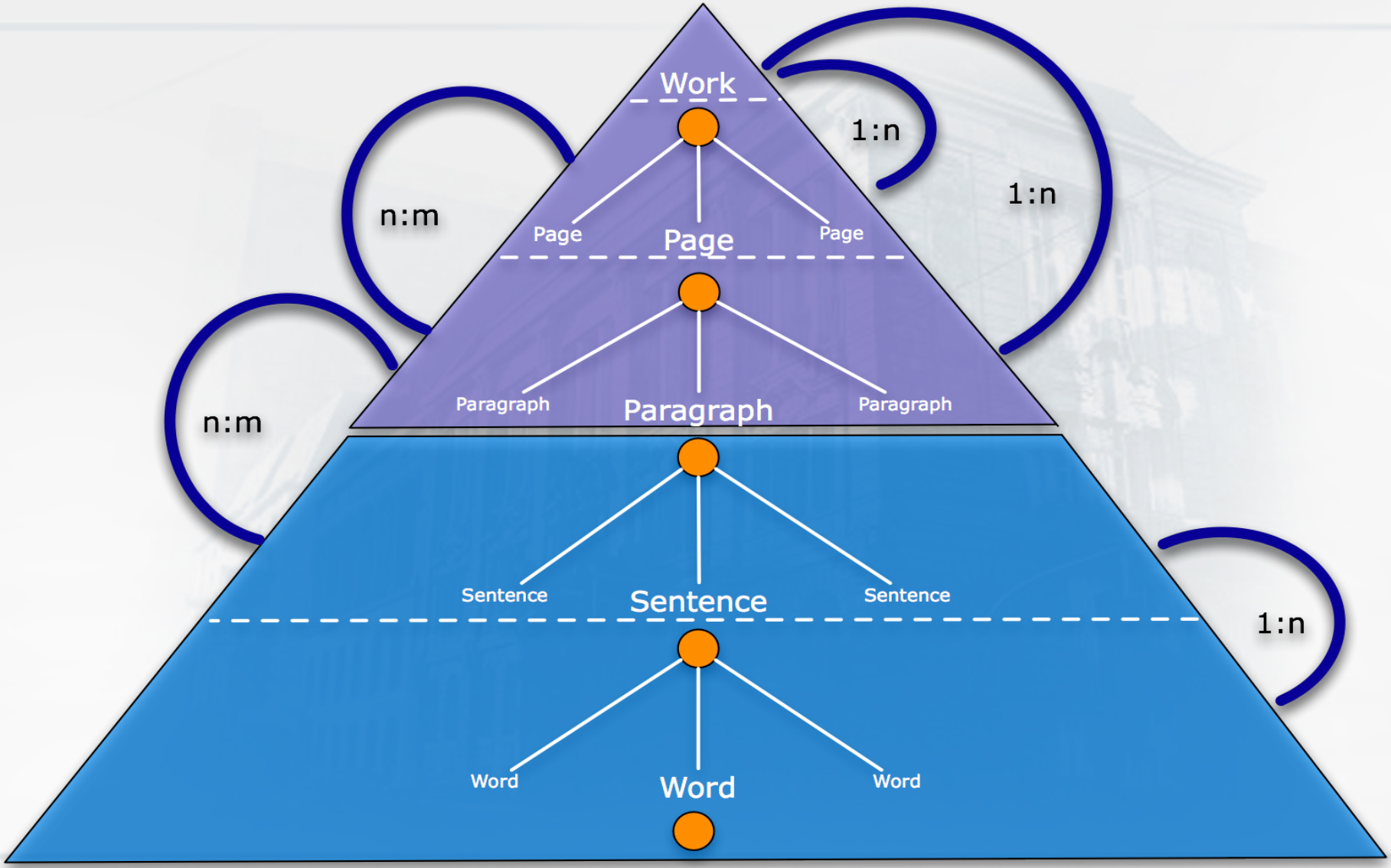
# Granular Semantic Publishing: Paux (1)



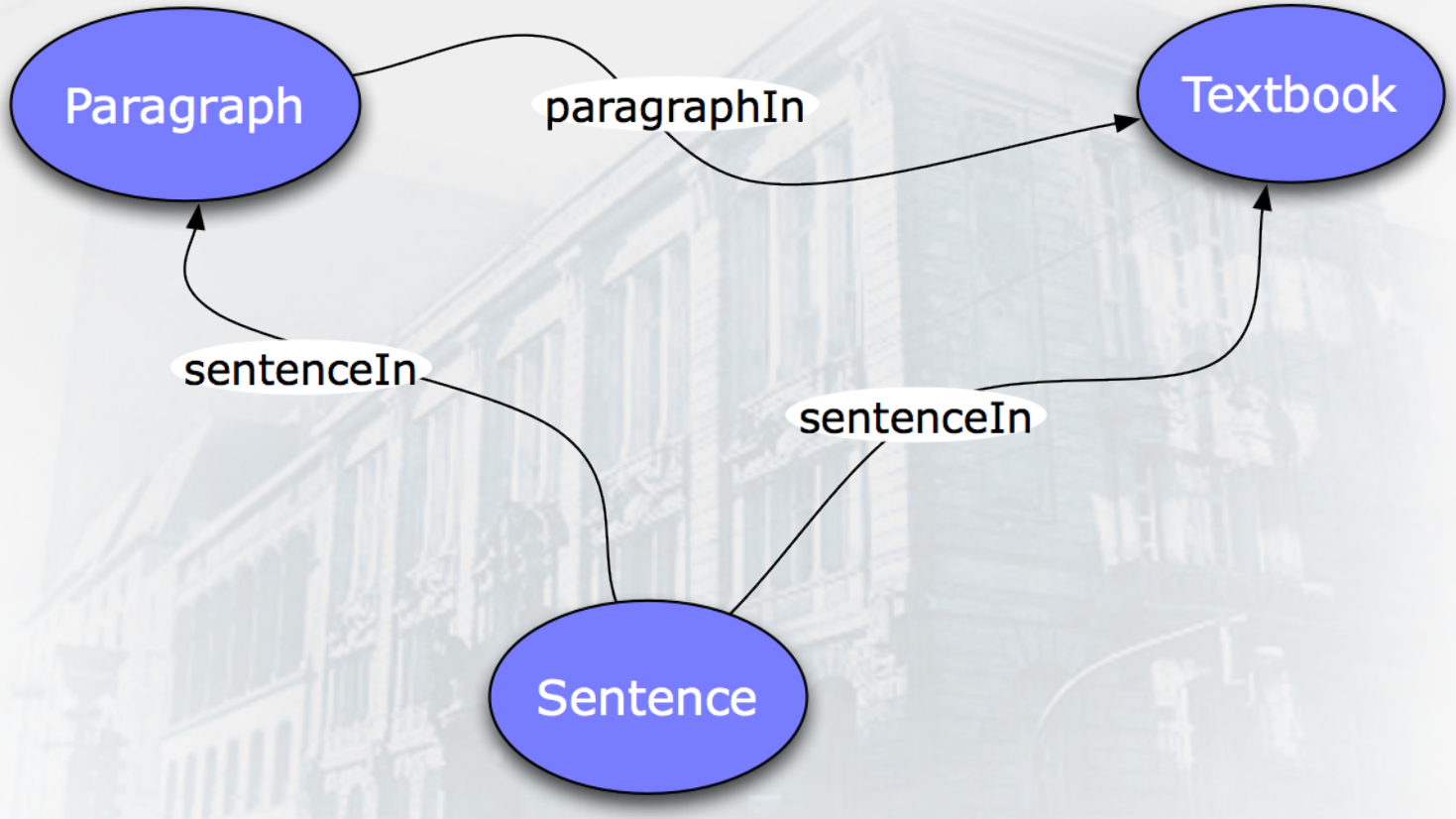
# Very Granular Semantic Publishing: Paux (2)



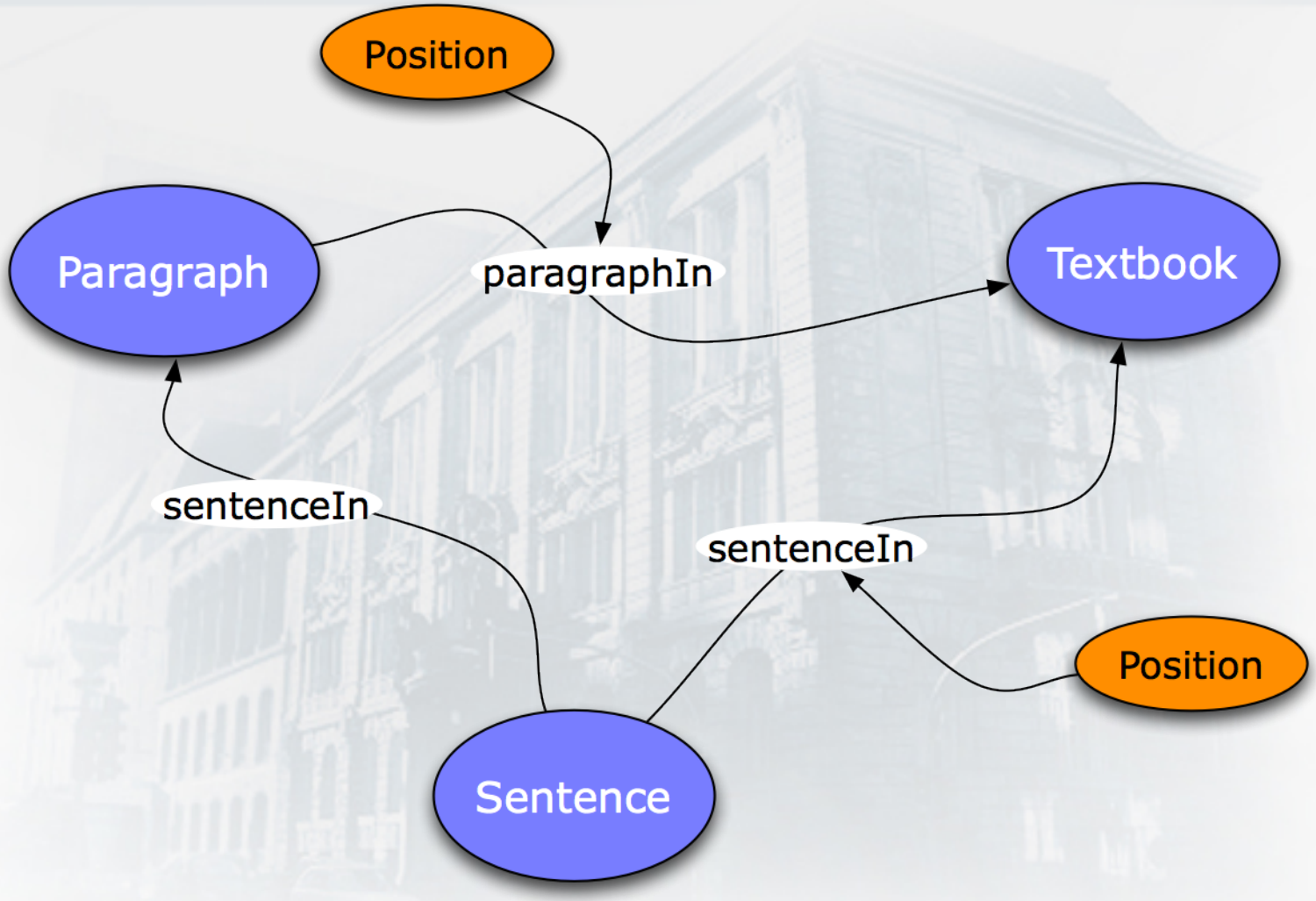
# Semantic Publishing: Paux (3)



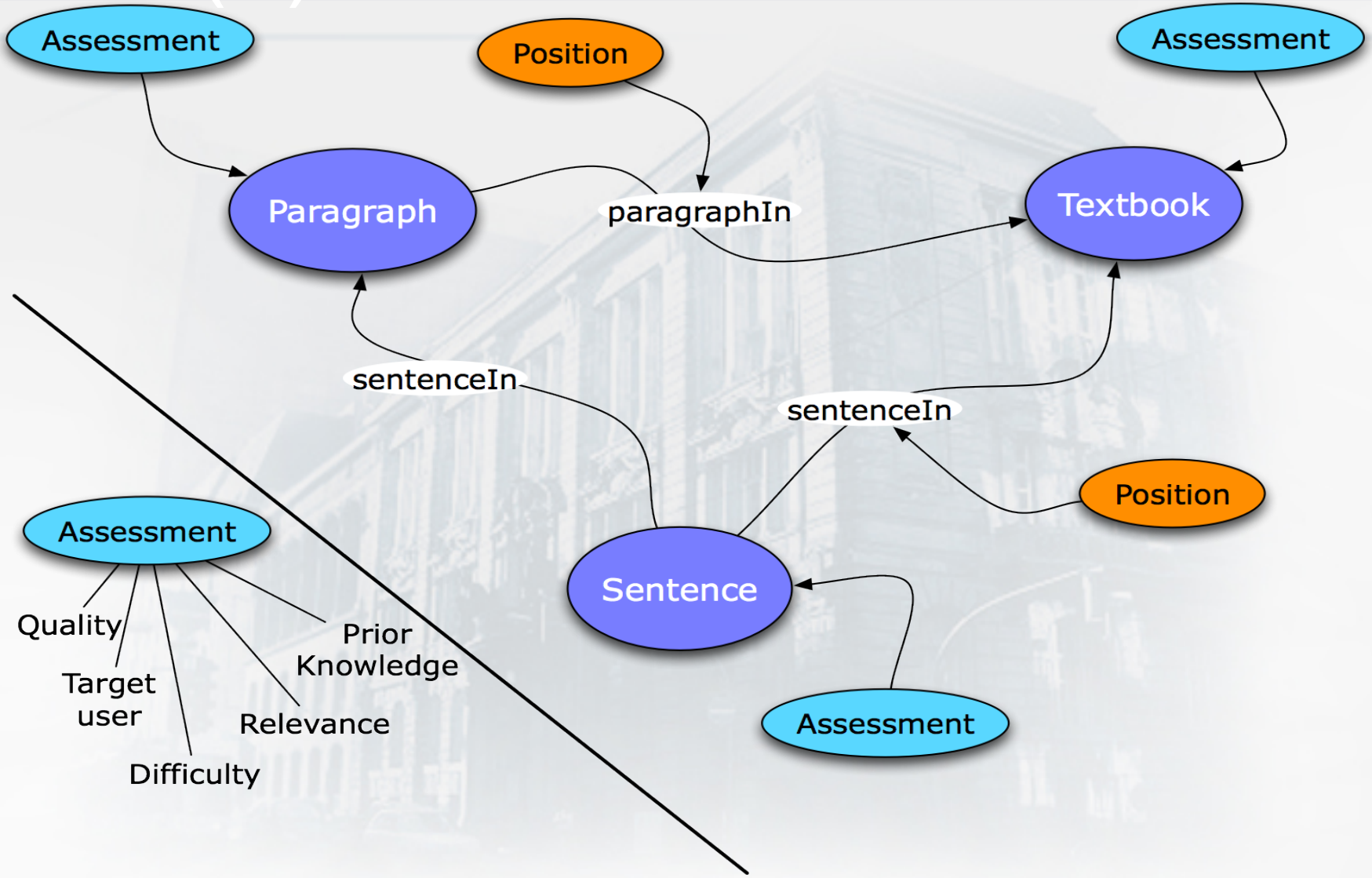
# Linked Semantic Publishing: Paux (4)



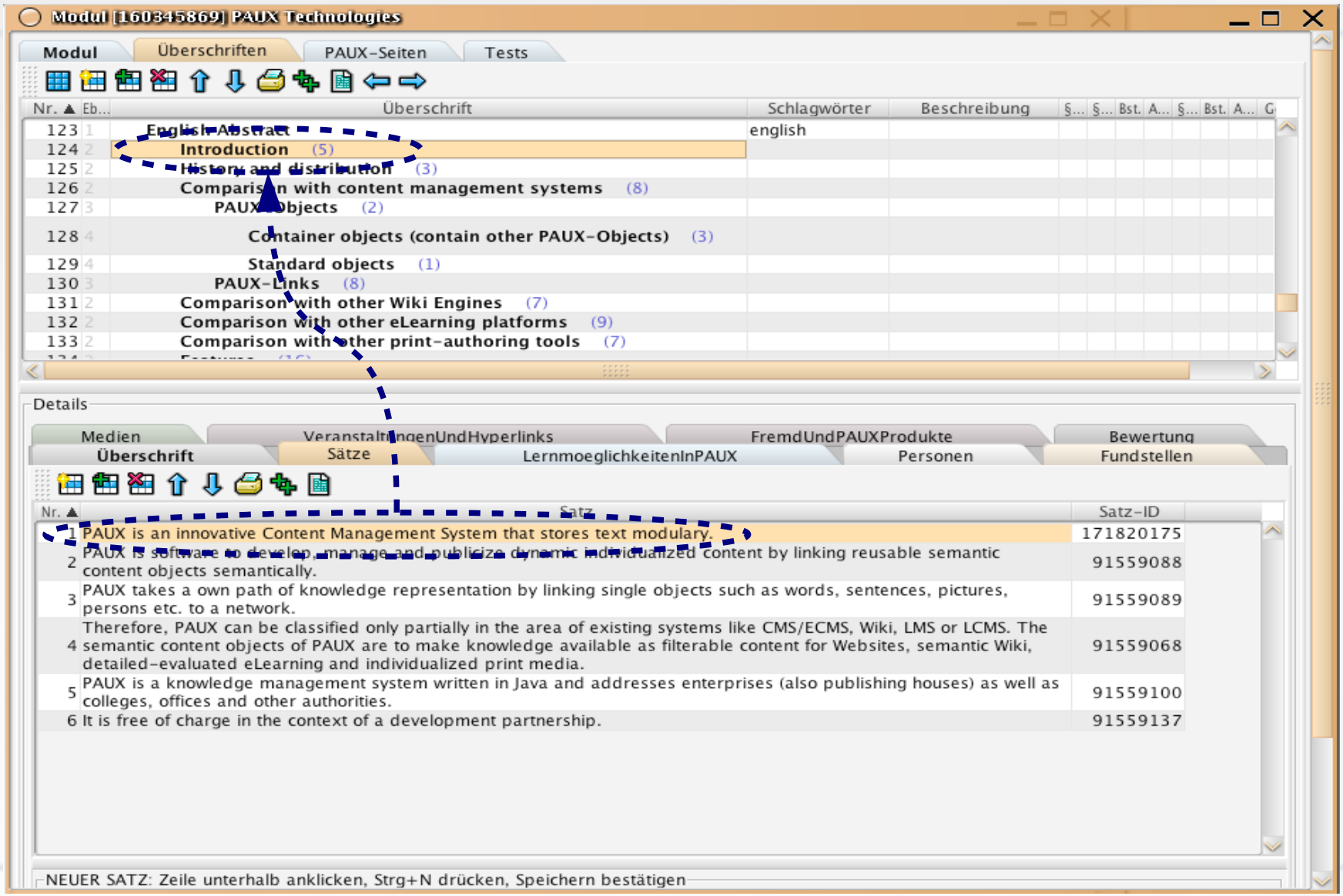
# Linked Semantic Publishing: Paux (5)



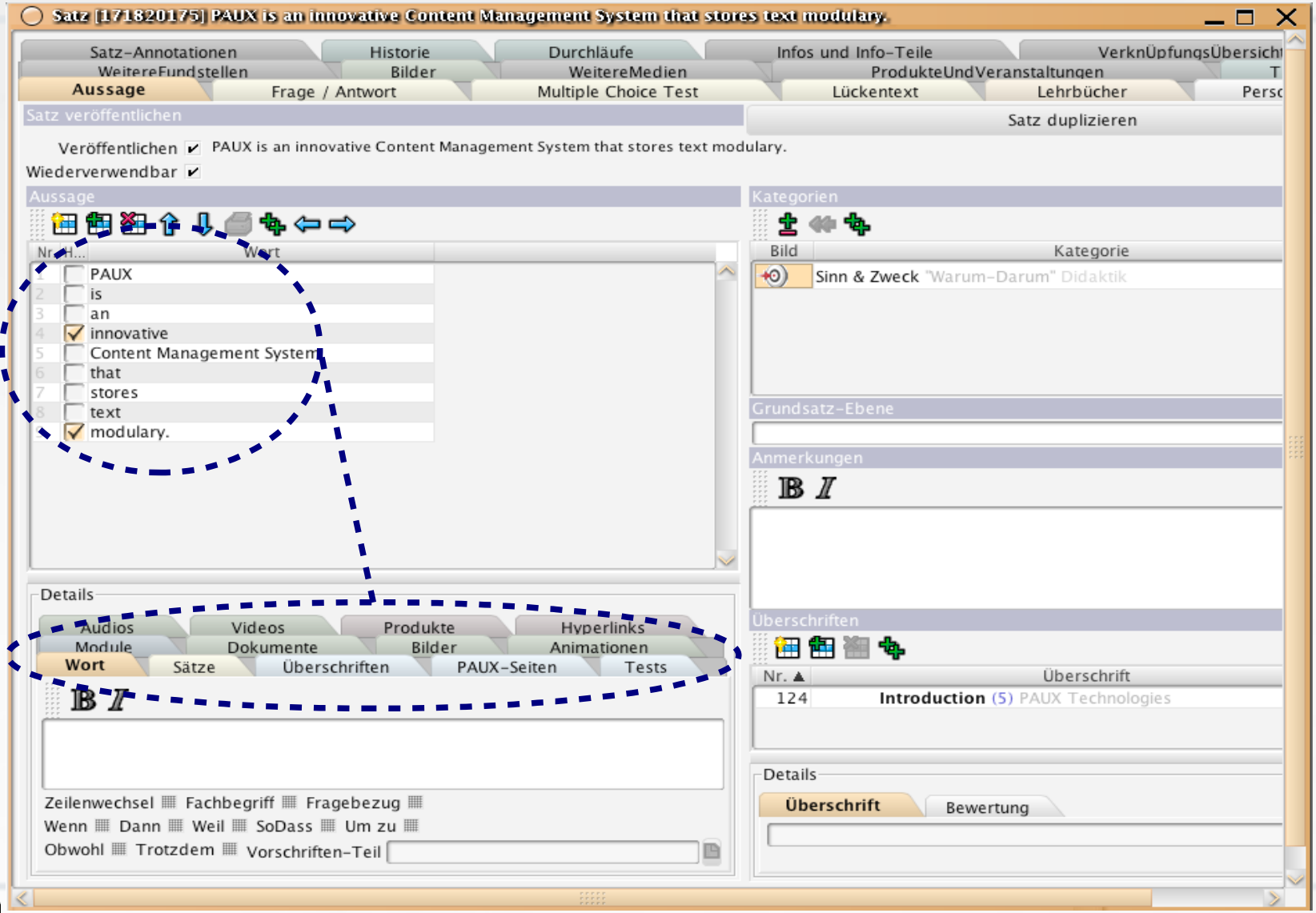
# Social Semantic Publishing: Paux (6)



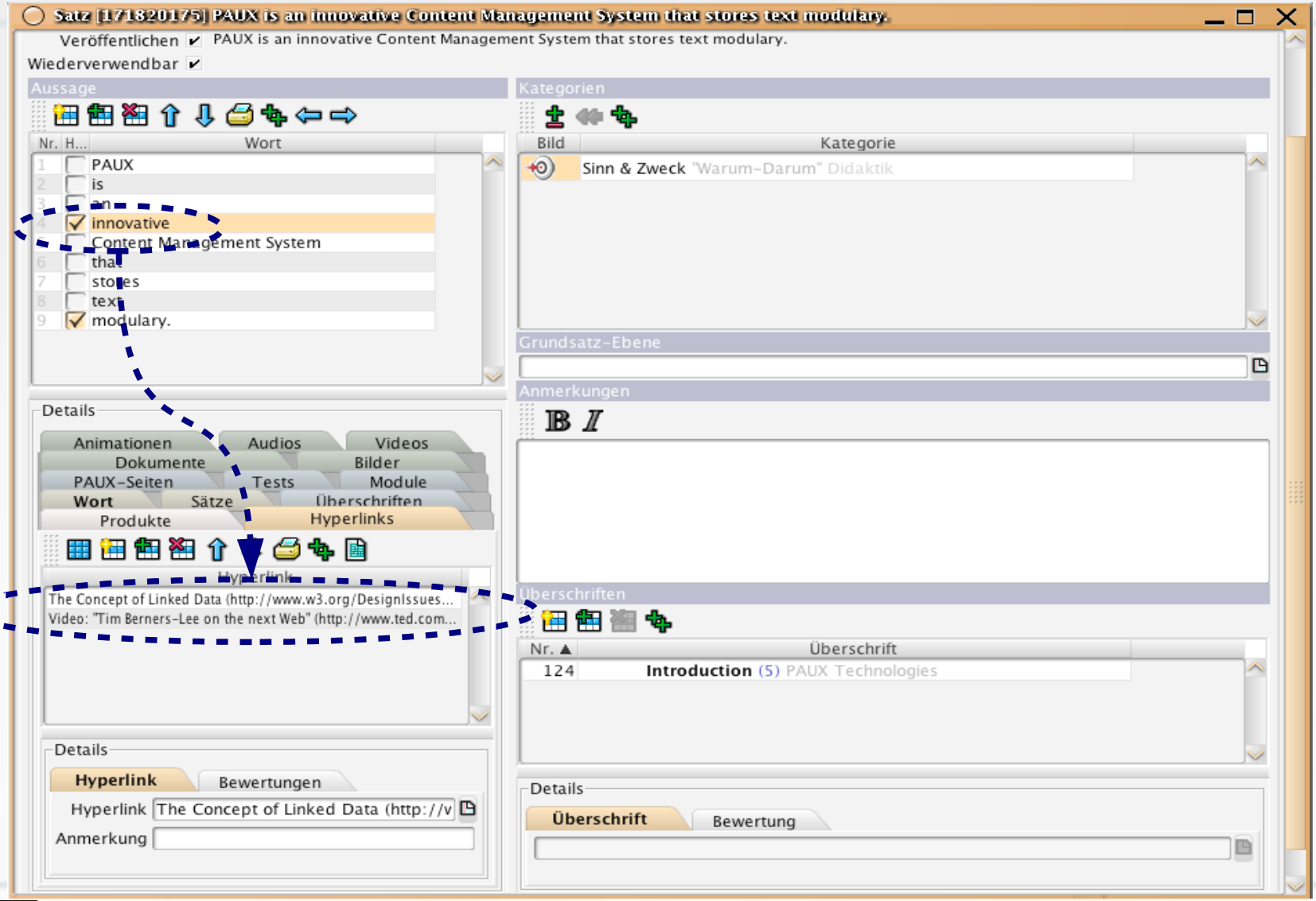
# Paux live (1): Outline & Sentences



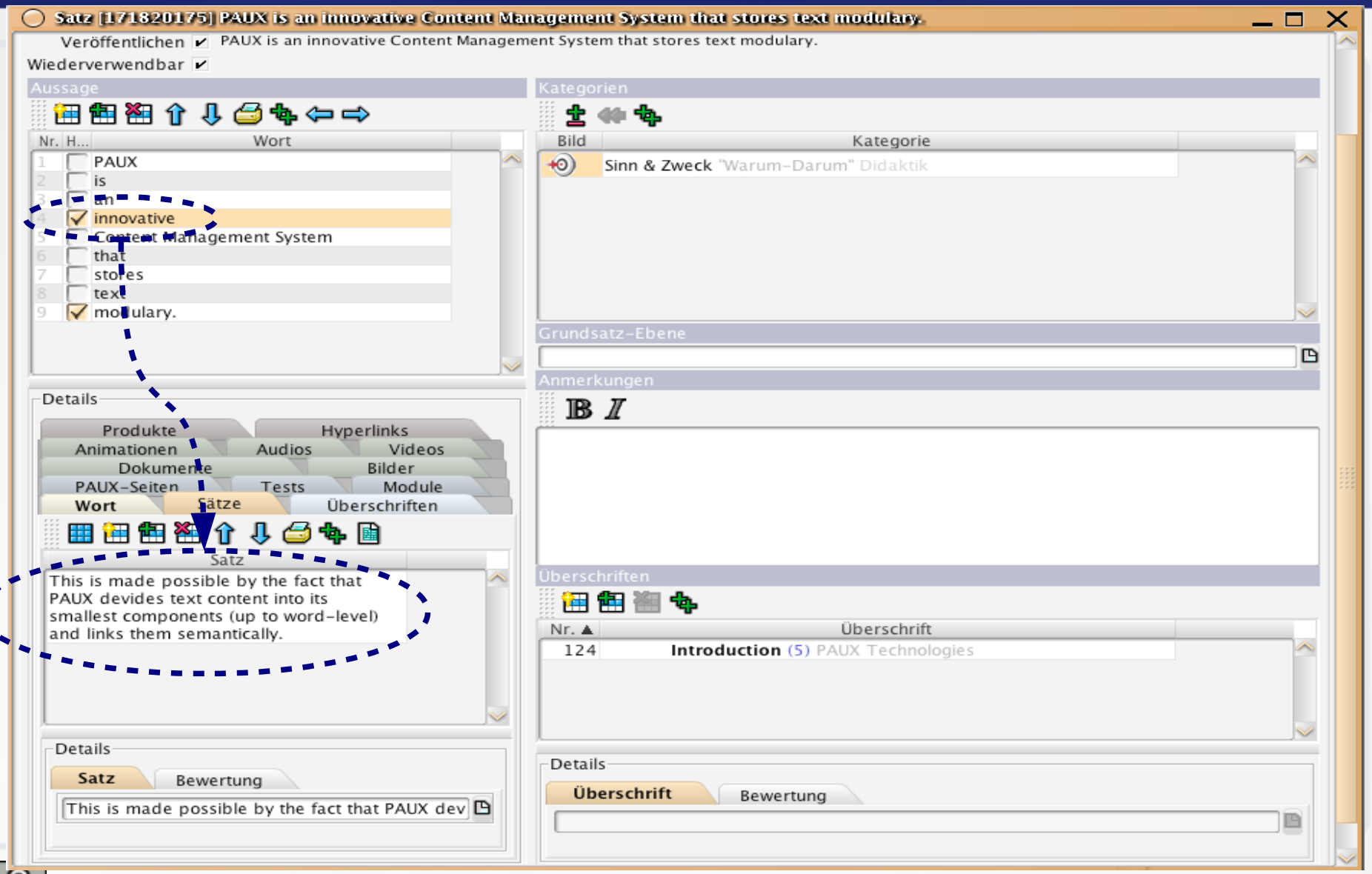
# Paux live (2): Sentence & Linking Options



# Paux live (3): Word & Hyperlinks



# Paux live (4): Word & Link to Sentence



# Data = Publication

- Distinction data vs. publication will get **increasingly obsolete** in semantic publishing environments …
- … at least in the STM sector.
- The move into semantic publication will be **much slower in the SSH** because of
  - fuzzy and unstable **terminology**
  - fuzzy **linking semantics** hard to formalise consistently
  - close relation between **complex document formats** and **scholarly discourse**
- Current examples are mostly from the medical and bio-medical area as a consequence.
- => Jan Velterop's concept of “Nano-Publications” or Bill Town's examples from chemistry (namely OreChem)

# “What do you do with a million books?” (G. Crane)

- DL view: digitisation and (more and more) semantic publishing **increase** by at least one or even more orders of magnitude
  - Scale
  - Linguistic heterogeneity of content
  - Granularity of objects
  - Noise (encoding and semantic)
  - Audience
- They may lead to a dramatic **decrease** of the number of collections and distributors
- They render obsolete the very notion of a '**collection**' ...
- … as well as the notion of a '**catalogue**'
- → ***Do we need more than one Digital Library in such a setting***?

# Re “What do you do with a million books?” (G. Crane)

- Scholarly view: digitisation and (increasingly) semantic publishing result in
  - growing quantity
  - increased complexity
- Well beyond scholarly processing capacity (=reading faculty)
- Multiplication of collections or distributors is annoying → as few as possible. Ideally just one (?)
- Scientists and Scolars will badly need help in these areas:
  - **Semantic abstracting**, **named entity recognition** for “strategic reading” (Renear)
  - **Contextualisation** of information objects
  - Robust **reasoning and inferencing** yielding digital heuristics

=> ***Opportunities for libraries … but for others, too!***

# Dessert
## Who else is going there?
## Partners and Contenders

# Partners and Contenders: A Mostly Ambivalent Scenario

- Commercial enterprises as **partners**
  - Document mining, named entity recognition and semantic aggregation (OpenCalais, Temis and others)
  - Search engine technology (Google and others)
  - Library automation suppliers (OCLC, ExLibris and others)
- Commercial enterprises as **contenders**
  - Google
  - Amazon
  - Publishers
  - OCLC
- Will other **digital libraries** be partners or contenders?

# Conclusion: Towards Semantic Libraries

Another triple paradigm shift

- Focus on **container** → focus on **content**
- Metadata **catalogue** → **semantic network** of contextualized object representations
- Information object **storage** and **retrieval** → **knowledge generation**

Or else the WWW will share the fate of the Concorde aircraft or of the Zeppelin (Eco) and *nothing of this is going to happen* …

… I don't believe so!

# Suggested Reading


- Gregory Crane (2006): What Do you Do with a Million Books? In: Dlib Magazine, Vol. 12, March. (http://www.dlib.org/dlib/march06/crane/03crane.html)
- David Shotton (2009a): Semantic Publishing. The coming revolution in scientific journal publishing. Learned Publishing Volume 22, No 2, 85–94, April 2009; doi:10.1087/2009202
- David Shotton et al. (2009b): Adventures in Semantic Publishing: Exemplar Semantic Enhancements of a Research Article (http://www.ploscompbiol.org/article/info:doi/10.1371/journal.pcbi.1000361)
- Barend Mons, Jan Velterop: Nano-Publication in the e-science era ( http://www.surffoundation.nl/SiteCollectionDocuments/Nano-Publication%20-%20Mons%20-%20Velterop.pdf )
- Alan Renear, Carol Palmer (2009): Strategic Reading, Ontologies and the Future of scientific Publishing. In: Science, August 2009, p. 828 – 832.


Thank you for your patience and attention